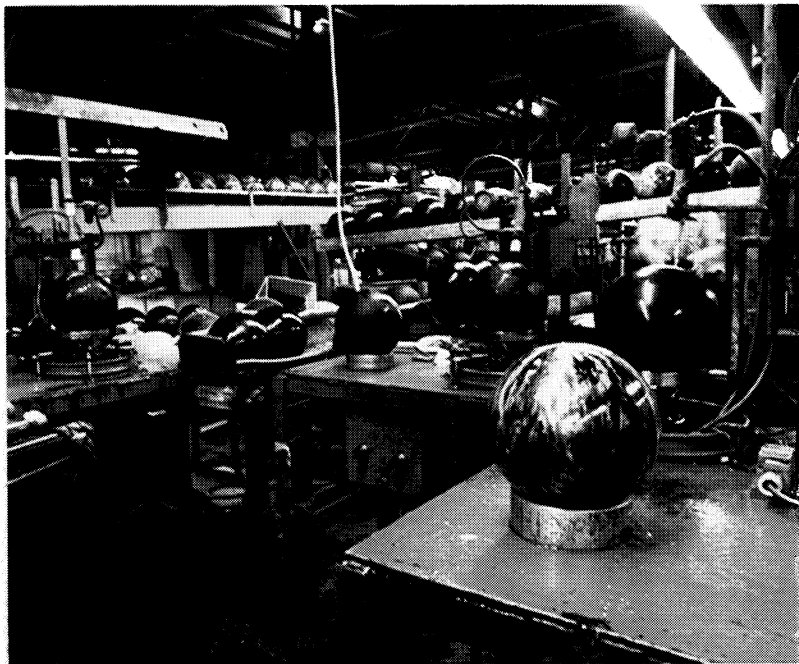
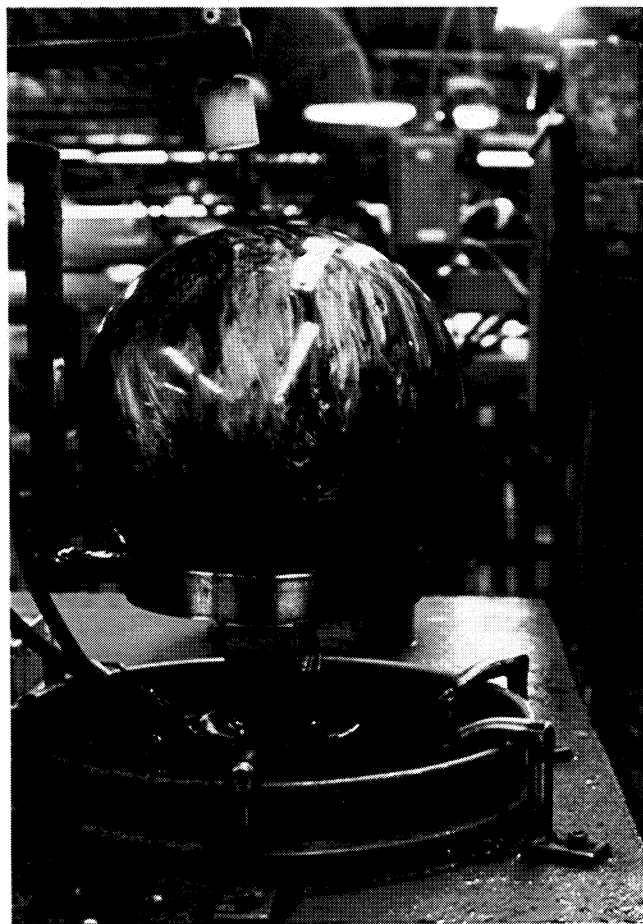


Bowling Ball Spotting



Ebonite International, whose Hopkinsville, Kentucky plant is shown in part at left, has been making bowling balls since 1907 and has become one of the leading manufacturers in the bowling equipment industry with a reputation for innovation. A recent innovation, introduced to the production line in 1984, is what the company calls the most accurate weighing and spotting system in operation. Called Exactatron, it was developed by Ebonite engineers with the help of technological information provided by NASA.

The weighing/spotting system is used to determine precisely the top dead center point of a bowling ball. The ball is "top weighted" during the manufacturing process, meaning that an area near the top is more dense—or heavier—than the rest of the ball. Top weight influences the spinning or hooking action of the ball, thus is important to professional bowlers—such as Earl Anthony (lower left)—who may want to personalize top weight by drilling a hole to modify the weight. This enables them to get a top weight best suited to their individual bowling styles, hence optimum ball performance.



To drill for top weighting, it is necessary to know exactly—within a small fraction of an inch—the top dead center spot. This was formerly accomplished at Ebonite by mechanical measurement, but the company felt it would be possible to develop a more precise system with modern technology. Ebonite outlined the problem to NASA and requested technological information that might be pertinent to development of a more advanced system. NASA conducted a computer search and responded by supplying three technical reports on work performed at Jet Propulsion Laboratory (JPL). One concerned a procedure and a fixture for determining with high accuracy the mass and center of mass of an object, regardless of its shape; the technology was originally developed for the Voyager interplanetary spacecraft but is applicable to many devices that require precise balance. The other reports described JPL research on techniques and apparatus for measuring the viscosities of liquids, which are not always known or easily measured. These reports provided an informational base for Ebonite's development of the Exactratron system for exact spotting of the drilling point for top weighting.

The Exactatron process is described in the accompanying photos. At left center, a ball is mounted on a circular ring then (below) lowered into a cylindrical basin containing a solution of calcium bromide, a liquid that has the proper specific gravity to allow the ball to float. The floating ball rotates momentarily as the heavy portion of the ball settles to the bottom of the calcium bromide bath. When the ball finds equilibrium and stops rotating, a plunger mechanism spots the center point and the marked ball is elevated and removed from the system (right).

